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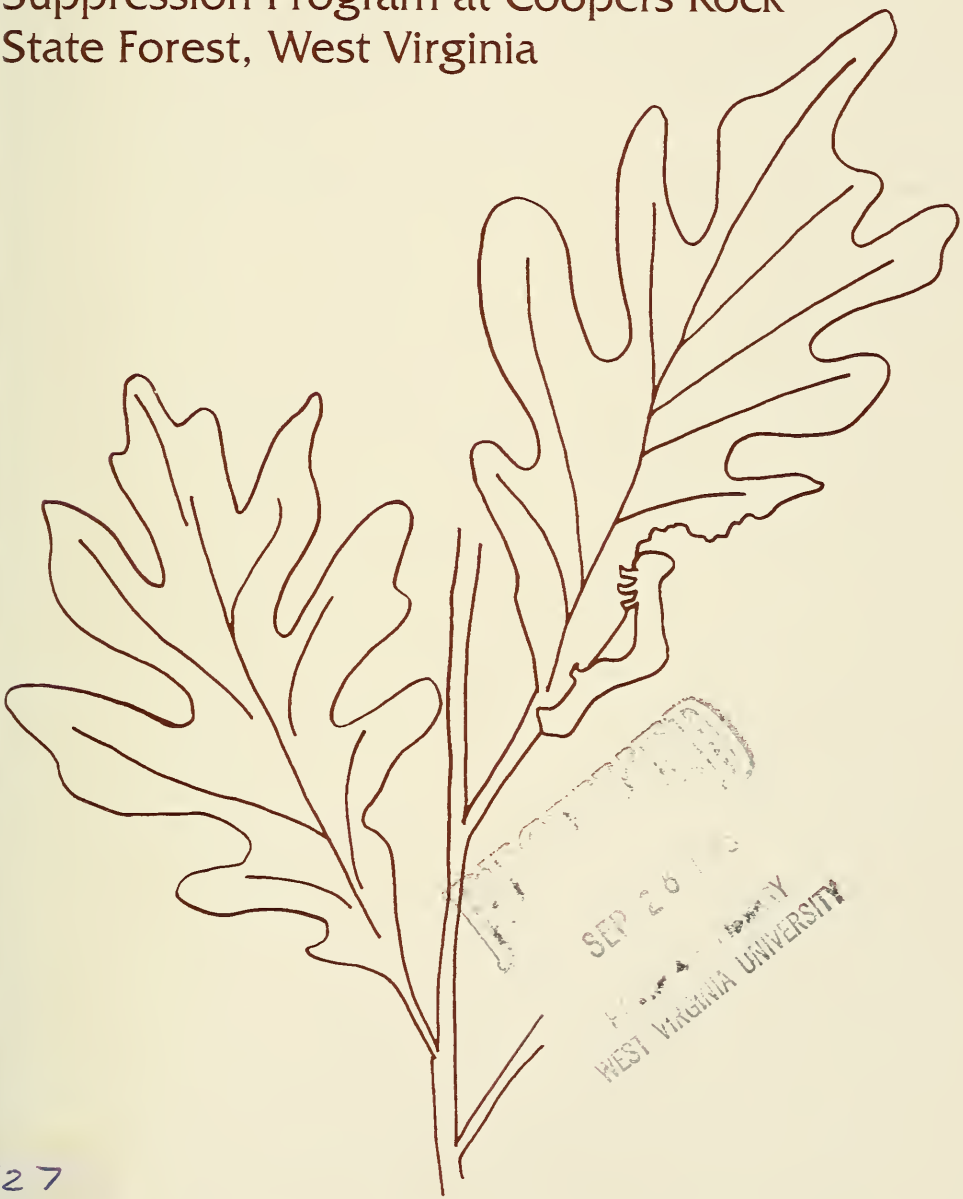

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Linda Butler and Vicki Kondo

Introduction

As gypsy moth, *Lymantria dispar* (L.) (Lepidoptera: Lymantriidae), continues to spread, so will the use of suppression efforts against it. To slow the spread of gypsy moth and reduce the defoliation it produces, large areas of deciduous forests are sprayed with diflubenzuron (Dimilin®)(1-(4-chlorophenyl)-3-(2,6-diflubenzoyl) urea). As part of the Cooperative USDA Forest Service–State Gypsy Moth Suppression Program, 269,445 hectares of forest land were treated with Dimilin in 1990 and 147,077 hectares in 1991 (USFS 1990, 1991).

Dimilin is an insect growth regulator, specifically a chitin synthetase inhibitor, which affects immature insects at a molt. In most instances it is ingested as the insect feeds on treated foliage.

In a gypsy moth suppression program, gypsy moth larvae are the intended targets. All other affected organisms are non-targets. The forest canopy is the intended recipient of the Dimilin spray. Within the canopy, as either permanent or periodic occupants, are numerous and diverse arthropods that are leaf-chewing or juice-feeding herbivores, predators, parasitoids, pollinators and scavengers. Of particular concern as non-target organisms in the forest canopy are Lepidoptera larvae. Caterpillars have been shown to be particularly vulnerable to Dimilin spray (Martinat et al. 1988), and they are considered to be important in the food chain of songbirds.

In 1990 the West Virginia Department of Agriculture applied Dimilin to about 312 hectares at the West Virginia University (WVU) Forest at Coopers Rock State Forest as part of an operational gypsy moth suppression program. An adjacent area on which long-term effects of gypsy moth defoliation were being evaluated was left untreated. Because baseline data on macrolepidopterous species richness and diversity had been collected at these sites previously (Butler and Kondo 1991, Butler 1992), we were interested in evaluating the impact of Dimilin on non-target Lepidoptera. The

scope of this project was limited in that we compared a single Dimilin-treated and control (untreated) block. We present here the results of the two-year study; 1990 was the treatment year and 1991 the post-treatment year.

Materials and Methods

This study was conducted at the WVU Forest at Coopers Rock State Forest, located in Preston and Monongalia counties about 32 km east of Morgantown, West Virginia. The area consists of a 50- to 60-year-old even-aged mixed mesophytic forest and has a mean elevation of 561 m (Carvell 1983). Over most of the study blocks, the canopy consists of oaks including white oak (*Quercus alba* L.), northern red oak (*Q. rubra* L.), chestnut oak (*Q. prinus* L.) and scarlet oak (*Q. coccinea* Muenchh.), and the understory is red maple (*Acer rubrum* L.), black cherry (*Prunus serotina* Ehrh.) and black birch (*Betula lenta* L.).

The Dimilin block was about 312 hectares and extended about one km north along both sides of Sand Spring Road from its intersection with W.Va. Route 73 on the south. The control block was approximately 243 hectares extending south from the Sand Spring Lookout Tower and encompassing Little Laurel Run Watershed.

Gypsy moth began moving into the study sites about 1984, but no noticeable defoliation occurred until 1989. Increasing egg mass counts triggered the spraying of several blocks in the vicinity with either Dimilin or *Bacillus thuringiensis* in 1990. No previous aerial insecticide treatments had been applied on the WVU Forest. The control block was designated in 1990 as a site for monitoring of long-term effects of gypsy moth defoliation.

Three sampling methods were employed: blacklight trapping of macrolepidopterous moths, and foliage pruning and canvas banding for larval sampling. Two blacklight traps were operated simultaneously, one each in the treated and control blocks one night each week from 20 April to 4 October 1990 and from 9 April to 30 September 1991. The traps were 15-watt, photo-cell controlled UV type (Ellisco Co., Philadelphia) set on tripod legs. Both trap sites were no closer than 150 m from the nearest clearing. All macrolepidopterous moths were identified. Counts were made for each species.

Macrolepidopterous larvae were collected by pole pruning of branch tips from the lower canopy of mixed oaks, red maple, black birch and black cherry. Prunings were taken from two locations in each block once each week from 9 May to 2 October 1990 and from 9 May to 25 September 1991. Pruning sites for the Dimilin block were in the vicinity of the light-trap site west of Sand Spring Road and east of Sand Spring Road just north of the telephone tower. On the control block, foliage was sampled in the vicinity of the light-trap site just north of the archery range and just south of the Sand Spring Lookout Tower.

A foliage sample consisted of 25 branch tips from each of the four plant species (mixed oaks, red maple, black cherry and black birch) taken at each site in each block. Thus, 16 samples were collected each week. Foliage was taken to the laboratory, examined, and all macrolepidopterous larvae were removed and identified to species. Any larvae that could not be identified immediately were reared on bouquets of foliage to more mature larvae or to the adult stage for identification.

Canvas bands for larval sampling were stapled around the tree circumference at breast height on five trees each of mixed oak, red maple, black cherry and black birch at each of the two sampling sites within each block for a total of 40 trees per block (total of 80 trees). Bands were installed 24 April 1990 and larvae removed and identified weekly until 22 August 1990 and from 16 April to 17 September 1991.

Dimilin 25W at 2 oz (56.7 g) of formulation/acre was aerially applied to the treatment block on 5 June 1990. Conditions at the time of application were favorable (clear, cool, calm winds) and leaf expansion was almost completed, thus presenting a virtually closed canopy.

Voucher specimens of larvae and adults from this study are deposited in the WVU Arthropod Collection. Species are named and listed after the checklist given by Hodges et al. (1983).

Results

A summary of the light-trap data is given in Table 1. Total species richness (number of species) for both treated and control sites was 405 species. The control site showed the highest richness for combined years with 361 species, while the treated site showed 331 species. When broken down by years, the highest richness (292 species) was seen for the control site in 1990. Total abundance (numbers of individuals) at both light-trap sites during both years was 30,392. For the two years combined, abundance was slightly greater at the control site.

Table 2 lists the 405 adult macrolepidopterous species taken during the study. Moths are listed in order of decreasing abundance with the geometrids *Lomographa glomeraria*, *Melanolophia canadaria*, *Itame pustularia* and *Iridopsis larvaria* being most abundant. It is of interest to note that the abundance of adult *Lomographa glomeraria* was about 40% higher at the control site in 1990, but adult populations were greatly reduced at both sites in 1991.

A total of 73 species of macrolepidopterous larvae was taken from pruned foliage samples during the study. Species richness and abundance by site and by year are given in Table 3. Gypsy moth larvae were the most abundant larvae collected. When gypsy moth larvae are deleted from the data, we note that prior to Dimilin application on 5 June 1990 (pre-1990),

non-target larvae were more abundant on the (to be) treated site whereas post-treatment 1990, non-target larvae were more abundant on the control site. Species richness was higher on the control site post-treatment 1990 and during 1991, but in 1991, larval abundance was similar on both sites. While total abundance for the two years was similar for both the treated and control sites, abundance for post-treatment 1990 and 1991 was higher for the control (407) than the treated site (369). For both years combined species richness was 56 on the treated site and 62 on the control site. The abundance of gypsy moth larvae decreased dramatically from pre-1990 to 1991 on the treated plot.

Table 4 lists the 73 species of macrolepidopterous larvae collected during the study in decreasing order of abundance. It is noted that early spring geometrid defoliators such as *Erannis tiliaria*, *Phigalia titea* and *Alsophila pometaria* were more abundant on the treated site. These species were probably little affected by the Dimilin treatment on 5 June 1990 since by that date most of the larvae had matured or were moving to the soil for pupation. Some of the more abundant species that may have been affected include *Orthosia hibisci*, *Itame pustularia*, *Lochmaeus manteo*, *Acronicta ovata*, *Orgyia leucostigma*, *Morrisonia confusa* and *Hydria prunivorata*.

A total of 41 species of non-target macrolepidoptera from eight families was taken from canvas bands on 80 trees on both study sites over 1990 and 1991 (Table 5, 6). The Dimilin treatment did not appear to affect non-target larval numbers under bands; abundance of larvae for both years combined was 332 individuals for the treated site and 337 for the control (Table 5). Gypsy moth larvae were seven times more abundant under bands on the control sites compared to treated sites.

Equal numbers of black birch, black cherry, red maple and mixed oak trees were banded. The greatest species richness and abundance were found under bands on black birch, the least under bands on oak (Table 7).

Discussion

Relatively few studies have been conducted on Dimilin impact on non-target forest canopy Lepidoptera. In a study conducted in Morgan County, West Virginia, Martinat et al. (1988) evaluated impact of Dimilin on foliage arthropods in chestnut and red oaks and red maple. They identified arthropods to species or to operational taxonomic units that were then pooled into higher categories for analysis. Included among the evaluated categories were macrolepidoptera larvae in general, the geometrid larva *Itame pustularia*, microlepidopterous larvae and other mandibulate herbivores. Dimilin was found to reduce abundance and species richness in mandibulate herbivores, especially macrolepidoptera.

Venables (1990) concluded that, potentially, 100% of the 223 baseline species of non-target macrolepidoptera in the National Capital Region around Washington, D.C. were susceptible to Dimilin applied for gypsy moth suppression. Her assessment took into account Dimilin residual time and the food plants, habitats, and seasonal appearance of the larval species under consideration.

Sample (1991) studied the impact of Dimilin on food for Virginia big-eared bat on seven pairs of treated and untreated plots in the Ridge and Valley topographic province of West Virginia. Blacklight traps were operated simultaneously in treated and untreated plots. He found that among the Lepidoptera, total species richness and species richness in four of eight Lepidoptera families was reduced. Of 83 macrolepidoptera species trapped in sufficiently high numbers for statistical analysis, 47 species were reduced.

The 1990–1991 study at the WVU Forest was not designed or executed in a way to permit statistical tests. The study was conducted on a single large Dimilin treated block that was part of an operational gypsy moth suppression program. The control block was an adjacent area that was available because it had been designated for long-term study of gypsy moth defoliation impact on trees and small streams. During 1990 several additional Dimilin and *Bacillus thuringiensis* spray blocks were located in the vicinity of the control block. While an effort was made to match light trap sites in the two blocks with regard to vegetational similarity, and specific tree species were pruned and banded on each block, there was no opportunity to match treated and control blocks prior to the study.

The late treatment application in 1990 presented problems. The canopy had almost completely closed, thus reducing penetration of Dimilin to the lower canopy where most foliage samples were taken. In addition many non-target larvae that were abundant early in the season were pre-pupae or pupae at the treatment date (5 June). At a properly timed gypsy moth treatment, these larvae would still have been in the canopy feeding.

Light trap results showed no trend between treated and control blocks. It should be noted that in the current study, results from a single pair of light traps are being compared. Because Sample (1990) operated seven pairs of light traps in treated and control plots he was able to show reduction in species richness and abundance among some families or species of Lepidoptera due to Dimilin treatment.

No impact on non-target macrolepidopterous larvae in the treated block was observed by sampling with canvas bands.

Species richness and abundance of larvae on foliage were lower in the treated block post-treatment 1990 and richness remained reduced in 1991. Martinat et al. (1988) also found a reduction in richness and abundance of macrolepidopterous larvae following Dimilin application.

It is of interest to compare richness and abundance of macrolepidopterous moths and larvae in the current study with baseline data collected in 1984–86. The baseline light-trap data for moths were collected by means of a single trap at the precise location as the trap placement at the treatment block in the current study (Butler and Kondo, 1991). That trap was operated weekly from late March to October as in the current study. Species richness in the earlier study was 325, 276 and 268 for 1984, 1985 and 1986 respectively; abundance was 11,055, 10,240 and 8,743 (Butler and Kondo, 1991). In contrast, in the more recent study, species richness was generally lower at treated and control sites and abundance was considerably lower with an average of 7,301 individuals per year in the treatment block trap and 7,894 individuals per year in the control trap.

Two years of foliage pruning from the same tree species groups and with comparable quantities of foliage yielded a macrolepidopterous larval richness of 100 species and abundance of 3,027 in the earlier baseline study (Butler, 1992). In the current study, total richness for two years was 73 species and total non-gypsy moth larval abundance was 1,080, an apparent reduction.

During 1990 over 2,840 hectares of forest in Coopers Rock State Forest were treated with either *B.t.* or Dimilin for gypsy moth suppression. In addition, noticeable gypsy moth defoliation had begun by 1989 and increased through 1990 on untreated blocks.

Our data indicate that between the time of our baseline studies in 1984–1986 and the Dimilin study in 1990–1991, species richness and abundance of macrolepidoptera declined at the West Virginia University Forest. While normal population fluctuation could account for some of this decline, we suggest that a portion of the decline is due to a combination of gypsy moth suppression and defoliation.

Summary

In 1990, as a part of a gypsy moth suppression program, Dimilin was aerially applied to a treatment block at the West Virginia University Forest at Coopers Rock State Forest on which a baseline study on macrolepidopterous species had been conducted in 1984 to 1986. An adjacent area of similar size was left untreated. We used blacklight trapping for adult moths and foliage pruning and tree banding for larvae to evaluate species richness and abundance on the treatment and control blocks. Because of the lack of replicated blocks and the late treatment date in 1990, no statistically significant differences were seen. Similar species richness and abundance were noted for light trapped moths and for larvae under bands on treated and control blocks. For larvae on foliage, the trend was for higher abundance on the treatment block prior to treatment and on the control block after

treatment. In 1990, larval abundance and richness were greater on the control block.

In comparing macrolepidopterous species richness and abundance in the current study with those of a baseline study for the same sites in 1984–1986, it appears that a reduction has occurred in abundance and richness. This reduction may result from a combination of impacts due to gypsy moth suppression efforts and defoliation.

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TABLE 1. Richness and abundance of adult macrolepidopterous moths taken by blacklight trap at Coopers Rock State Forest, West Virginia (1990–1991).

Site	Year	Richness	Abundance
Treated	1990	257	7,867
Treated	1991	275	6,736
Treated	both	331	14,603
Control	1990	292	8,747
Control	1991	289	7,042
Control	both	361	15,789
Total Richness, Abundance		405	30,392

TABLE 2. Macrolepidopterous moths† taken by blacklight trap at Coopers Rock State Forest, West Virginia. Species are listed in decreasing order of total abundance for both treated (T) and control (C) blocks for 1990 and 1991.

SPECIES	Family	T90	C90	T91	C91	ABUND
Lomographa glomeraria (Grt.)	Geo	1495	2482	88	83	4148
Melanolophia canadaria (Gn.)	Geo	232	346	564	684	1826
Itame pustularia (Gn.)	Geo	495	208	358	446	1507
Iridopsis larvaria (Gn.)	Geo	130	215	655	470	1470
Orthosia hibisci (Gn.)	Noc	364	263	244	148	1019
Idia rotundalis (Wlk.)	Noc	480	372	76	82	1010
Halysidota tessellaris (J.E. Smith)	Arc	173	211	261	300	945
Probole amicaria (H.-S.)	Geo	199	103	243	253	798
Idia aemula Hbn.	Noc	154	180	103	140	577
Lomographa vestaliata (Gn.)	Geo	46	62	222	208	538
Besma quercivoraria (Gn.)	Geo	80	85	192	147	504
Bomolocha baltimoralis (Gn.)	Noc	136	142	107	88	473
Campaea perlata (Gn.)	Geo	225	123	49	69	466
Malacosoma disstria Hbn.	Las	117	92	100	88	397
Polia detracta (Wlk.)	Noc	177	85	62	69	393
Hydrelia inornata (Hulst)	Geo	53	53	126	150	382
Semiothisa aemulataria (Wlk.)	Geo	32	31	139	158	360
Orthodes cynica (Gn.)	Noc	55	96	102	100	353
Eupithecia herefordaria C.&S.	Geo	.	.	155	167	322
Epimecis hortaria (F.)	Geo	76	89	45	88	298
Acronicta ovata Grt.	Noc	74	43	87	66	270
Nadata gibbosa (J.E. Smith)	Not	119	100	16	33	268
Besma endropiaria (G.&R.)	Geo	55	22	91	83	251
Eupithecia miserulata Grt.	Geo	128	100	7	14	249
Callopistria mollissima(Gn.)	Noc	40	64	66	77	247
Malacosoma americanum (F.)	Las	97	61	26	42	226
Acronicta increta Morr.	Noc	82	35	58	41	216
Peridea angulosa (J.E. Smith)	Not	69	91	18	35	213
Lymantria dispar (L.)	Lym	45	86	36	41	208
Abagrotis alternata (Grt.)	Noc	83	78	27	16	204

SPECIES	Family	T90	C90	T91	C91	ABUND
Homochlodes disconventa (Wlk.)	Geo	19	55	23	92	189
Euplexia benesimilis McD.	Noc	20	34	68	62	184
Tetracis cachexiata Gn.	Geo	37	44	58	32	171
Acronicta hasta Gn.	Noc	52	69	20	30	171
Acronicta inclara Sm.	Noc	63	31	46	30	170
Zanclognatha ochreipennis (Grt.)	Noc	74	59	20	15	168
Heterocampa guttivitta (Wlk.)	Not	47	53	35	30	165
Orgyia leucostigma (J.E. Smith)	Lym	18	31	62	54	165
Pero honestaria (Wlk.)	Geo	25	38	19	77	159
Orthosia rubescens (Wlk.)	Noc	56	57	26	18	157
Morrisonia confusa (Hbn.)	Noc	35	46	39	35	155
Clemensia albata Pack.	Arc	7	17	55	73	152
Anorthodes tarda (Gn.)	Noc	72	57	9	14	152
Phigalia titea (Cram.)	Geo	28	9	38	63	138
Dryocampa rubicunda (F.)	Sat	18	53	21	46	138
Idia diminuendis (B.&McD.)	Noc	34	42	40	21	137
Xestia dolosa Franc.	Noc	43	39	22	31	135
Biston betularia (L.)	Geo	7	21	54	50	132
Hyphantria cunea (Drury)	Arc	18	54	30	24	126
Chytolita morbidalis (Gn.)	Noc	58	37	18	8	121
Psaphida resumens Wlk.	Noc	90	27	3	.	120
Elaphria festivoides (Gn.)	Noc	40	23	26	29	118
Scopula limboundata (Haw.)	Geo	27	49	5	34	115
Lochmaeus manteo Doubleday	Not	27	40	22	24	113
Anathix ralla (G.&R.)	Noc	24	22	45	22	113
Symmerista albifrons (J.E. Smith)	Not	31	26	25	29	111
Drepana arcuata Wlk.	Dre	13	46	30	21	110
Crocigrapha normani (Grt.)	Noc	25	59	4	21	109
Pero morrisonaria (Hy. Edw.)	Geo	13	10	47	37	107
Hydriomena divisaria (Wlk.)	Geo	22	23	35	26	106
Zale minerea (Gn.)	Noc	15	64	12	11	102
Dasychira basiflava (Pack.)	Lym	13	48	22	15	98
Hyperstrotia pervertens (B.&McD.)	Noc	26	9	36	27	98
Dasychira dorsipennata (B.&McD.)	Lym	5	30	26	36	97
Nacophora quernaria (J.E. Smith)	Geo	6	4	55	30	95
Hydria prunivorata (Fgn.)	Geo	2	5	25	63	95
Pseudorthodes vecors (Gn.)	Noc	4	2	51	38	95
Polia latex (Gn.)	Noc	32	23	10	29	94
Hypagyrtis unipunctata (Haw.)	Geo	11	23	27	32	93
Meganola minuscula (Zell.)	Noc	23	21	24	20	88
Acronicta modica Wlk.	Noc	28	14	16	28	86
Polygrammate hebraeicum Hbn.	Noc	21	11	29	24	85
Xestia bicarnea (Gn.)	Noc	13	17	27	27	84
Phoberia atomaris Hbn.	Noc	35	40	5	2	82
Lytrosis unitaria (H.-S.)	Geo	5	13	28	34	80

SPECIES	Family	T90	C90	T91	C91	ABUND
Platysenta vecors (Gn.)	Noc	6	31	16	26	79
Lambdina pellucidaria (G.&R.)	Geo	12	21	27	16	76
Renia sobrialis (Wlk.)	Noc	24	25	15	12	76
Acronicta haesitata (Grt.)	Noc	26	11	22	14	73
Acronicta fragilis Gn.	Noc	26	19	13	12	70
Polia nimbosa (Gn.)	Noc	13	19	15	22	69
Cabera erythemaria Gn.	Geo	12	25	16	12	65
Plagodis alcoolaria (Gn.)	Geo	29	17	14	5	65
Hyperaeschra georgica (H.-S.)	Not	30	24	3	8	65
Zanclognatha laevigata (Grt.)	Noc	20	25	10	9	64
Heliomata cycladata G.&R.	Geo	2	.	52	8	62
Cladara atroliturata (Wlk.)	Geo	29	24	4	5	62
Macrurocampa marthesia (Cram.)	Not	14	24	7	16	61
Oligocentria semirufescens (Wlk.)	Not	14	15	14	16	59
Zale lunifera (Hbn.)	Noc	19	23	3	14	59
Paonias excaecatus (J.E. Smith)	Sph	19	13	15	11	58
Phlogophora periculosa Gn.	Noc	16	12	20	7	55
Chytonix palliatricula (Gn.)	Noc	26	8	7	14	55
Calledapteryx dryopterata Grt.	Epi	19	17	3	15	54
Cyclophora pendulinaria (Gn.)	Geo	3	9	16	24	52
Idia americalis (Gn.)	Noc	4	7	18	22	51
Lithacodia carneola (Gn.)	Noc	1	4	19	27	51
Plagodis phlogosaria (Gn.)	Geo	5	22	12	11	50
Dasychira obliquata (G.&R.)	Lym	.	1	26	23	50
Plathypena scabra (F.)	Noc	8	21	9	12	50
Pangrapta decoralis Hbn.	Noc	15	4	21	10	50
Pleuroprucha insulsaria (Gn.)	Geo	3	8	19	19	49
Anagoga occiduaria (Wlk.)	Geo	10	21	7	10	48
Apatelodes torrefacta (J.E. Smith)	Apa	5	24	4	15	48
Eutrapela clemataria (J.E. Smith)	Geo	3	24	9	10	46
Semiothisa ocellinata (Gn.)	Geo	1	6	10	28	45
Ectropis crepuscularia (D.&S.)	Geo	10	12	13	10	45
Semiothisa pinistrobata Fgn.	Geo	1	3	25	15	44
Plagodis serinaria H.-S.	Geo	12	16	7	9	44
Prochoerodes transversata (Drury)	Geo	12	10	12	10	44
Catocala ultronia (Hbn.)	Noc	16	3	21	4	44
Zanclognatha lituralis (Hbn.)	Noc	17	14	4	8	43
Lithacodia muscosula (Gn.)	Noc	.	.	12	31	43
Paonias myops (J.E. Smith)	Sph	2	7	19	14	42
Heterocampa biundata Wlk.	Not	10	11	7	12	40
Nephelodes minians Gn.	Noc	9	9	8	14	40
Cleora sublunaria (Gn.)	Geo	24	7	3	5	39
Panopoda rufimargo (Hbn.)	Noc	17	7	4	10	38
Euchlaena obtusaria (Hbn.)	Geo	6	14	8	9	37
Eugonobapta nivosaria (Gn.)	Geo	15	11	5	6	37

SPECIES	Family	T90	C90	T91	C91	ABUND
Nemoria bistriaria Hbn.	Geo	1	12	11	13	37
Hypoprepia fucosa Hbn.	Arc	1	16	4	16	37
Pseudaletia unipuncta (Haw.)	Noc	18	4	6	9	37
Xestia normaniana (Grt.)	Noc	2	13	8	14	37
Anavitrinelia pampinaria (Gn.)	Geo	7	12	9	8	36
Metarranthis duaria (Gn.)	Geo	8	9	13	6	36
Hyperstrotia secta (Grt.)	Noc	21	12	3	.	36
Euchlaena tigrinaria (Gn.)	Geo	3	4	10	18	35
Phalaenophana pyramusalis (Wlk.)	Noc	8	19	1	6	34
Baileya levitans (Sm.)	Noc	3	20	2	9	34
Egira alternans (Wlk.)	Noc	17	11	2	4	34
Nola triquetrana (Fitch)	Noc	19	7	.	7	33
Amphipyra pyramidoides Gn.	Noc	11	7	8	7	33
Glena cribrataria (Gn.)	Geo	8	10	5	9	32
Protoboarmia porcelaria (Gn.)	Geo	7	10	8	7	32
Homorthodes furfurata (Grt.)	Noc	1	.	18	13	32
Nematocampa limbata (Haw.)	Geo	4	7	12	8	31
Metarranthis hypocharia (H.-S.)	Geo	7	19	3	.	29
Phalaenostola larentioides Grt.	Noc	10	13	4	2	29
Orthonama centrostrigaria (Woll.)	Geo	7	11	6	4	28
Aethalura intertexta (Wlk.)	Geo	.	1	13	13	27
Olceclostera angelica (Grt.)	Apa	2	23	.	1	26
Renia discoloralis Gn.	Noc	13	12	.	1	26
Xanthorhoe ferrugata (Cl.)	Geo	8	15	.	2	25
Eudryas grata (F.)	Noc	3	17	1	4	25
Orthonama obstipata (F.)	Geo	2	4	6	11	23
Spilosoma virginica (F.)	Arc	1	8	5	9	23
Zanclognatha pedipilalis (Gn.)	Noc	11	7	.	5	23
Parallelia bistriaris Hbn.	Noc	12	5	2	4	23
Catocala amica (Hbn.)	Noc	11	2	7	3	23
Melanolophia signataria (Wlk.)	Geo	.	1	14	6	21
Euphyia unangulata (Haw.)	Geo	1	5	7	8	21
Meganola spodia Franclemont	Noc	3	1	7	10	21
Pyrrharctia isabella (J.E. Smith)	Arc	2	11	4	3	20
Sunira bicolorago (Gn.)	Noc	5	10	3	2	20
Eulithis diversilineata (Hbn.)	Geo	4	6	1	8	19
Dasylophia anguina (J.E. Smith)	Not	6	11	1	1	19
Palthis angulalis (Hbn.)	Noc	7	2	3	7	19
Acronicta tristis Sm.	Noc	6	4	4	5	19
Holomelina nigricans (Reak.)	Arc	.	.	12	6	18
Thioptera nigrofimbria (Gn.)	Noc	1	2	3	12	18
Cyclophora packardi (Prout)	Geo	1	2	8	6	17
Zale unilineata (Grt.)	Noc	2	7	4	4	17
Lithophane hemina Grt.	Noc	14	3	.	.	17
Agrotis ipsilon (Hufn.)	Noc	6	6	2	3	17

SPECIES	Family	T90	C90	T91	C91	ABUND
Pyreferra hesperidago (Gn.)	Noc	6	5	5	.	16
Morrisonia evicta (Grt.)	Noc	6	5	3	2	16
Ochropleura plecta (L.)	Noc	.	2	5	9	16
Xestia badinodis (Grt.)	Noc	1	4	1	10	16
Euchlaena irraria (B.&McD.)	Geo	5	4	3	3	15
Antepione thisoaria (Gn.)	Geo	1	1	3	10	15
Heterocampa umbrata Wlk.	Not	5	2	4	4	15
Oligia illocata (Wlk.)	Noc	5	2	7	1	15
Achatia distincta Hbn.	Noc	6	4	4	1	15
Spaelotis clandestina (Harr.)	Noc	9	6	.	.	15
Euchlaena marginaria (Minot)	Geo	.	.	6	8	14
Autographa precationis (Gn.)	Noc	7	3	.	4	14
Acronicta caesarea Sm.	Noc	3	2	6	3	14
Feltia herilis (Grt.)	Noc	.	2	5	7	14
Xestia smithii (Snell.)	Noc	2	1	1	10	14
Lithacodia synochitis (G.&R.)	Noc	1	3	3	6	13
Acronicta retardata (Wlk.)	Noc	3	2	6	2	13
Phyllodesma americana (Harr.)	Las	4	7	.	1	12
Zanclognatha jacchusalis (Wlk.)	Noc	2	5	4	1	12
Bomolocha deceptalis (Wlk.)	Noc	3	6	2	1	12
Cerma cerintha (Tr.)	Noc	5	2	2	3	12
Colocasia propinquilinea (Grt.)	Noc	3	2	3	4	12
Copivaleria grotei (Morr.)	Noc	.	10	.	2	12
Furcula borealis (Guer.-Meneville)	Not	.	9	.	2	11
Spilosoma latipennis Stretch	Arc	.	3	4	4	11
Zale lunata (Drury)	Noc	.	6	1	4	11
Acronicta americana (Harr.)	Noc	3	7	.	1	11
Diarsia jucunda (Wlk.)	Noc	3	.	4	4	11
Rivula propinqualis Gn.	Noc	1	6	1	2	10
Cissusa spadix (Cram.)	Noc	6	2	1	1	10
Pseudothyatira cymatophoroides (Gn.)	Thy	1	.	3	5	9
Xanthotype urticaria Swett	Geo	1	3	3	2	9
Lambdina fervidaria (Hbn.)	Geo	7	2	.	.	9
Sicya macularia (Harr.)	Geo	1	7	.	1	9
Peridea basitriens (Wlk.)	Not	1	7	.	1	9
Idia scobialis (Grt.)	Noc	2	4	1	2	9
Phalaenostola eumelusalis (Wlk.)	Noc	4	5	.	.	9
Lithacodia musta (G.&R.)	Noc	1	7	.	1	9
Balsa labecula (Grt.)	Noc	2	4	1	2	9
Heliothis zea (Boddie)	Noc	1	1	5	2	9
Gluphisia septentrionis Wlk.	Not	.	8	.	.	8
Cycnia tenera Hbn.	Arc	2	3	3	.	8
Baileya ophthalmica (Gn.)	Noc	2	5	1	.	8
Acronicta innotata Gn.	Noc	1	2	1	4	8
Galgula partita Gn.	Noc	3	.	4	1	8

SPECIES	Family	T90	C90	T91	C91	ABUND
Eupsilia sidus (Gn.)	Noc	2	2	4	.	8
Actias luna (L.)	Sat	.	1	3	3	7
Datana ministra (Drury)	Not	2	4	.	1	7
Caenurgina erechtea (Cram.)	Noc	1	2	1	3	7
Catocala neogama (J.E. Smith)	Noc	.	.	3	4	7
Anagrapha falcifera (Kby.)	Noc	.	2	2	3	7
Acronicta impleta Wlk.	Noc	3	.	2	2	7
Oligia crytora (Franc.)	Noc	1	4	1	1	7
Eutolype rolandi Grt.	Noc	5	1	1	.	7
Leucania ursula (Fbs.)	Noc	1	2	3	1	7
Leucania pseudargyria Gn.	Noc	6	.	.	1	7
Metanema inatomaria (Gn.)	Geo	.	2	2	2	6
Plagodis fervidaria (H.S.)	Geo	2	3	1	.	6
Eusarca confusaria Hbn.	Geo	.	6	.	.	6
Anticlea vasiliata Gn.	Geo	.	4	1	1	6
Peridea ferruginea (Pack.)	Not	2	4	.	.	6
Schizura unicornis (J.E. Smith)	Not	4	1	.	1	6
Oligocentria lignicolor (Wlk.)	Not	.	.	3	3	6
Ecpantheria scribonia (Stoll)	Arc	.	1	3	2	6
Phalaenostola metonalis (Wlk.)	Noc	.	.	3	3	6
Euparthenos nubilis (Hbn.)	Noc	3	2	.	1	6
Allotria elonympha (Hbn.)	Noc	.	.	5	1	6
Catocala palaeogama Gn.	Noc	.	.	1	5	6
Lithacodia albidula (Gn.)	Noc	.	2	.	4	6
Acronicta lobeliae Gn.	Noc	4	2	.	.	6
Elaphria versicolor (Grt.)	Noc	1	1	1	3	6
Lithophane semiusta Grt.	Noc	2	4	.	.	6
Lacinipolia renigera (Steph.)	Noc	1	2	2	1	6
Orthosia alurina (Sm.)	Noc	.	.	1	5	6
Feltia subgothica (Haw.)	Noc	3	3	.	.	6
Vanessa atalanta (L.)	Nym	1	.	.	4	5
Habrosyne scripta (Gosse)	Thy	.	.	2	3	5
Lambdina fiscellaria (Gn.)	Geo	3	2	.	.	5
Heterophleps triguttaria H.-S.	Geo	.	.	2	3	5
Hypoprepia miniata (Kby.)	Arc	.	.	.	5	5
Cisseps fulvicollis (Hbn.)	Arc	.	2	1	2	5
Bomolocha abalienalis (Wlk.)	Noc	3	2	.	.	5
Chrysanympha formosa (Grt.)	Noc	3	1	1	.	5
Agroperina helva (Grt.)	Noc	.	.	1	4	5
Oligia modica (Gn.)	Noc	1	.	2	2	5
Papaipema baptisiae (Bird)	Noc	2	2	.	1	5
Phlogophora iris Gn.	Noc	1	.	4	.	5
Phosphila miselioides (Gn.)	Noc	2	1	2	.	5
Elaphria grata Hbn.	Noc	3	2	.	.	5
Pyreferra citrombra Franc.	Noc	3	2	.	.	5

SPECIES	Family	T90	C90	T91	C91	ABUND
Orthodes crenulata (Butler)	Noc	.	2	2	1	5
Oreta rosea (Wlk.)	Dre	1	2	1	.	4
Phigalia denticulata Hulst	Geo	.	.	2	2	4
Heterophleps refusaria (Wlk.)	Geo	.	.	1	3	4
Deidamia inscripta (Harr.)	Sph	.	4	.	.	4
Lophocampa caryae Harr.	Arc	1	.	3	.	4
Zanclognatha cruralis (Gn.)	Noc	2	2	.	.	4
Papaipema lysimachiae Bird	Noc	1	.	.	3	4
Papaipema marginidens (Gn.)	Noc	1	1	1	1	4
Elaphria chalcedonia (Hbn.)	Noc	.	.	2	2	4
Platysenta sutor (Gn.)	Noc	1	.	1	2	4
Lithophane antennata (Wlk.)	Noc	1	2	1	.	4
Eucirroedia pampina (Gn.)	Noc	.	.	2	2	4
Ulolonche culea (Gn.)	Noc	.	4	.	.	4
Anomogyna dilucida (Morr.)	Noc	.	2	.	2	4
Cerastis tenebrifera (Wlk.)	Noc	.	.	4	.	4
Heptagrotis phyllophora (Grt.)	Noc	2	2	.	.	4
Euthyatira pudens (Gn.)	Thy	1	.	.	2	3
Selenia kentaria (G.&R.)	Geo	.	.	1	2	3
Cepphis armataria (H.&S.)	Geo	.	1	1	1	3
Dyspteris abortivaria (H.-S.)	Geo	.	.	3	.	3
Clostera inclusa (Hbn.)	Not	1	1	1	.	3
Ellida caniplaga (Wlk.)	Not	.	2	1	.	3
Heterocampa obliqua Pack.	Not	.	1	.	2	3
Schizura ipomoeae Doubleday	Not	.	1	1	1	3
Holomelina opella (Grt.)	Arc	1	2	.	.	3
Euchaetes egle (Drury)	Arc	.	2	.	1	3
Idia forbesi (French)	Noc	.	.	2	1	3
Idia lubricalis (Gey.)	Noc	.	.	.	3	3
Palthis asopialis (Gn.)	Noc	.	2	.	1	3
Spargaloma sexpunctata Grt.	Noc	2	.	.	1	3
Catocala blandula Hulst	Noc	.	1	.	2	3
Acronicta impressa Wlk.	Noc	.	3	.	.	3
Oligia fractilinea (Grt.)	Noc	.	.	1	2	3
Spodoptera frugiperda (J.E. Smith)	Noc	.	.	1	2	3
Cosmia calami (Harv.)	Noc	1	2	.	.	3
Lacanobia legitima (Grt.)	Noc	1	.	.	2	3
Leucania lapidaria (Grt.)	Noc	.	.	3	.	3
Anicla infecta (Ochs.)	Noc	.	.	2	1	3
Eueretagrotis attenta (Grt.)	Noc	3	.	.	.	3
Semiothisa granitata (Gn.)	Geo	.	.	2	.	2
Ennomos subsignaria (Hbn.)	Geo	.	.	1	1	2
Tetracis crocallata Gn.	Geo	1	.	.	1	2
Scopula inductata (Gn.)	Geo	2	.	.	.	2
Horisme intestinata (Gn.)	Geo	.	.	1	1	2

SPECIES	Family	T90	C90	T91	C91	ABUND
Automeris io (F.)	Sat	.	1	1	.	2
Callosamia angulifera (Wlk.)	Sat	.	.	1	1	2
Laothoe juglandis (J.E. Smith)	Sph	.	.	2	.	2
Pheosia rimosa Pack.	Not	.	.	.	2	2
Odontosia elegans (Stkr.)	Not	.	1	.	1	2
Schizura leptinoides (Grt.)	Not	.	1	1	.	2
Haploa clymene (Brown)	Arc	.	1	.	1	2
Haploa lecontei (Guer.-Meneville)	Arc	.	1	.	1	2
Apantesis vittata (F.)	Arc	.	1	.	1	2
Tetanolita mynesalis (Wlk.)	Noc	.	.	2	.	2
Bleptina caradrinalis Gn.	Noc	.	.	.	2	2
Lascoria ambigualis Wlk.	Noc	1	.	.	1	2
Bomolocha madefactalis (Gn.)	Noc	1	1	.	.	2
Metalectra discalis (Grt.)	Noc	1	1	.	.	2
Panopoda carneicosta Gn.	Noc	2	.	.	.	2
Catocala habilis Grt.	Noc	1	1	.	.	2
Catocala retecta Grt.	Noc	1	.	1	.	2
Catocala crataegi Saund.	Noc	.	2	.	.	2
Catocala micronympha Gn.	Noc	.	.	2	.	2
Eosphoropteryx thyatyroides (Gn.)	Noc	.	.	2	.	2
Leuconycta lepidula (Grt.)	Noc	.	.	2	.	2
Tarachidia erastrioides (Gn.)	Noc	.	2	.	.	2
Acronicta spinigera Gn.	Noc	.	.	2	.	2
Acronicta interrupta Gn.	Noc	.	2	.	.	2
Acronicta pruni Harr.	Noc	1	1	.	.	2
Hyppa xylinoides (Gn.)	Noc	.	.	.	2	2
Perigea xanthioides Gn.	Noc	.	1	.	1	2
Ogdoconta cinereola (Gn.)	Noc	.	2	.	.	2
Protorthodes oviduca (Gn.)	Noc	.	.	.	2	2
Peridroma saucia (Hbn.)	Noc	1	1	.	.	2
Xestia tenuicula (Morr.)	Noc	.	2	.	.	2
Protolampra brunneicollis (Grt.)	Noc	1	1	.	.	2
Semiothisa bicolorata (F.)	Geo	.	.	.	1	1
Phigalia strigataria (Minot)	Geo	.	.	1	.	1
Lomographa semiclarata (Wlk.)	Geo	.	1	.	.	1
Euchlaena serrata (Drury)	Geo	.	.	.	1	1
Xanthotype sospeta (Drury)	Geo	.	.	.	1	1
Ennomos magnaria Gn.	Geo	.	1	.	.	1
Caripeta divisata Wlk.	Geo	.	.	1	.	1
Synchlora aerata (F.)	Geo	.	.	.	1	1
Chlorochlamys chloroleucaria (Gn.)	Geo	.	1	.	.	1
Idaea furciferata (Pack.)	Geo	.	1	.	.	1
Dysstroma truncata (Hufn.)	Geo	.	.	.	1	1
Hydriomena pluviata (Gn.)	Geo	.	.	1	.	1
Stamnodes gibbicostata (Wlk.)	Geo	.	1	.	.	1

SPECIES	Family	T90	C90	T91	C91	ABUND
Trichodezia albovittata (Gn.)	Geo	.	.	.	1	1
Cladara limitaria (Wlk.)	Geo	.	.	1	.	1
Cicinnus melsheimeri (Harr.)	Mim	.	.	1	.	1
Heteropacha rileyana Harv.	Las	.	1	.	.	1
Hyalophora cecropia (L.)	Sat	.	.	1	.	1
Darapsa myron (Cram.)	Sph	.	.	.	1	1
Clostera albosigma Fitch	Not	.	.	.	1	1
Nerice bidentata Wlk.	Not	.	.	1	.	1
Gluphisia avimacula Hudson	Not	.	.	1	.	1
Lochmaeus bilineata (Pack.)	Not	.	1	.	.	1
Crambidia pallida Pack.	Arc	.	1	.	.	1
Apantesis nais (Drury)	Arc	.	1	.	.	1
Apantesis virgo (L.)	Arc	1	.	.	.	1
Hormisa orciferalis Wlk.	Noc	.	.	1	.	1
Tetanolita floridana (Sm.)	Noc	.	.	1	.	1
Renia salusalis (Wlk.)	Noc	.	.	1	.	1
Bomolocha sordidula (Grt.)	Noc	.	.	.	1	1
Bomolocha edictalis (Wlk.)	Noc	1	.	.	.	1
Scolecocampa liburna (Gey.)	Noc	1	.	.	.	1
Anticarsia gemmatalis Hbn.	Noc	.	.	1	.	1
Melipotis indomita (Wlk.)	Noc	1	.	.	.	1
Zale phaeocapna Franc.	Noc	.	.	.	1	1
Caenurgina crassiuscula (Haw.)	Noc	.	.	.	1	1
Catocala ilia (Cram.)	Noc	.	1	.	.	1
Catocala coccinata Grt.	Noc	.	.	.	1	1
Autographa biloba (Steph.)	Noc	1	.	.	.	1
Paectes oculatrix (Gn.)	Noc	.	.	1	.	1
Leuconycta diphteroides (Gn.)	Noc	.	.	.	1	1
Tarachidia candefacta (Hbn.)	Noc	.	1	.	.	1
Charadra deridens (Gn.)	Noc	.	1	.	.	1
Raphia frater Grt.	Noc	.	.	.	1	1
Acronicta rubricoma Gn.	Noc	.	1	.	.	1
Acronicta dactylina Grt.	Noc	.	.	1	.	1
Acronicta lithospila Grt.	Noc	.	1	.	.	1
Agriopodes teratophora (H.-S.)	Noc	1	.	.	.	1
Eudryas unio (Hbn.)	Noc	.	.	1	.	1
Agroperina dubitans (Wlk.)	Noc	.	1	.	.	1
Amphipoea americana (Speyer)	Noc	.	.	.	1	1
Papaipema cerussata (Grt.)	Noc	.	1	.	.	1
Iodopepla u-album (Gn.)	Noc	.	.	.	1	1
Ipimorpha pleonectusa Grt.	Noc	.	.	.	1	1
Magusa orbifera (Wlk.)	Noc	.	.	.	1	1
Amphipyra tragopoginis (Cl.)	Noc	1	.	.	.	1
Balsa tristrigella (Wlk.)	Noc	.	.	.	1	1
Lithophane innominata (Sm.)	Noc	.	1	.	.	1

SPECIES	Family	T90	C90	T91	C91	ABUND
Lithophane querquera Grt.	Noc	.	1	.	.	1
Lithophane unimoda (Lint.)	Noc	.	.	1	.	1
Eupsilia morrisoni (Grt.)	Noc	.	.	1	.	1
Chaetaglaea sericea (Morr.)	Noc	1	.	.	.	1
Polia imbrifera (Gn.)	Noc	.	1	.	.	1
Polia goodelli (Grt.)	Noc	.	1	.	.	1
Melanchra adjuncta (Gn.)	Noc	.	.	.	1	1
Lacanobia lutra (Gn.)	Noc	.	1	.	.	1
Lacinipolia lorea (Gn.)	Noc	.	1	.	.	1
Himella intractata (Morr.)	Noc	.	.	1	.	1
Tricholita signata (Wlk.)	Noc	.	.	1	.	1
Feltia geniculata (G.&R.)	Noc	.	.	.	1	1
Euagrotis illapsa (Wlk.)	Noc	.	1	.	.	1
Diarsia rubifera (Grt.)	Noc	.	.	1	.	1
Eueretagrotis perattenta (Grt.)	Noc	.	.	.	1	1

†Geo = Geometridae, Noc = Noctuidae, Arc = Arctiidae, Las = Lasiocampidae, Not = Notodontidae, Lym = Lymantriidae, Sat = Saturniidae, Dre = Drepanidae, Sph = Sphingidae, Epi = Epiplemidae, Apa = Apatelodidae, Thy = Thyatiridae, Nym = Nymphalidae, Mim = Mimalonidae.

TABLE 3. Richness and abundance of non-target macrolepidopterous larval species taken from foliage during pre-treatment 1990, post-treatment 1990 and 1991 at the treated and control sites at Coopers Rock State Forest, West Virginia. Numbers in parentheses indicate abundance of gypsy moth larvae.

	Treated		Control	
Period	Richness	Abundance	Richness	Abundance
Pre-1990	15	173 (444)	14	131 (506)
Post-1990	42	184 (146)	45	224 (199)
1991	33	185 (9)	40	183 (183)
Total	56	542 (599)	62	538 (888)

TABLE 4. Macrolepidopterous larvae† taken from pruned foliage at Coopers Rock State Forest, West Virginia. Species are listed in decreasing order of total abundance for both treated (T) and control (C) blocks for 1990 and 1991.

SPECIES	FAMILY	T90	C90	T91	C91	ABUND
Lymantria dispar (L.)	Lym	590	705	9	183	1487
Orthosia hibisci (Gn.)	Noc	44	53	10	35	142
Melanolophia canadaria (Gn.)	Geo	33	34	38	23	128
Itame pustularia (Gn.)	Geo	38	44	.	5	87
Lochmaeus manteo Doubleday	Not	20	48	.	8	76

SPECIES	Family	T90	C90	T91	C91	ABUND
Erannis tiliaria (Harr.)	Geo	42	16	3	.	61
Phigalia titea (Cram.)	Geo	32	15	9	3	59
Acronicta ovata Grt.	Noc	8	18	11	8	45
Polia latex (Gn.)	Noc	8	7	10	13	38
Lomographa vestaliata (Gn.)	Geo	3	5	13	11	32
Orgyia leucostigma (J.E. Smith)	Lym	1	14	9	8	32
Alsophila pometaria (Harr.)	Geo	21	4	5	1	31
Morrisonia confusa (Hbn.)	Noc	4	6	9	12	31
Amphipyra pyramidoides Gn.	Noc	17	5	1	5	28
Lomographa glomeraria (Grt.)	Geo	13	8	3	1	25
Campaea perlata (Gn.)	Geo	2	5	11	7	25
Malacosoma disstria Hbn.	Las	17	1	.	.	18
Nadata gibbosa (J.E. Smith)	Not	7	8	.	1	16
Halysidota tessellaris (J.E. Smith)	Arc	1	4	4	6	15
Besma endropiaria (G.&R.)	Geo	1	2	6	5	14
Hydria prunivorata (Fgn.)	Geo	.	.	11	.	11
Phigalia strigataria (Minot)	Geo	4	1	4	1	10
Hypagyrtis unipunctata (Haw.)	Geo	5	.	4	.	9
Dryocampa rubicunda (F.)	Sat	1	3	5	.	9
Hyphantria cunea (Drury)	Arc	.	2	2	4	8
Bomolocha baltimoralis (Gn.)	Noc	.	2	3	3	8
Acronicta americana (Harr.)	Noc	2	4	.	1	7
Iridopsis larvaria (Gn.)	Geo	3	1	1	1	6
Probole amicaria (H.-S.)	Geo	1	1	2	2	6
Eutrapela clemataria (J.E. Smith)	Geo	3	2	.	1	6
Dasychira basiflava (Pack.)	Lym	1	5	.	.	6
Pseudothyatira cymatophoroides (Gn.)	Thy	1	2	1	1	5
Biston betularia (L.)	Geo	1	1	2	1	5
Paleacrita merriccata Dyar	Geo	5	.	.	.	5
Besma quercivoraria (Gn.)	Geo	2	2	1	.	5
Hydrelia inornata (Hulst)	Geo	1	1	1	1	4
Peridea angulosa (J.E. Smith)	Not	2	2	.	.	4
Acronicta fragilis Gn.	Noc	.	3	.	1	4
Papilio glaucus L.	Pap	.	.	.	3	3
Drepana arcuata Wlk.	Dre	.	3	.	.	3
Anavitrinelia pampinaria (Gn.)	Geo	1	.	1	1	3
Tetracis cachexiata Gn.	Geo	1	1	.	1	3
Malacosoma americanum (F.)	Las	1	2	.	.	3
Macrurocampa marthesia (Cram.)	Not	1	2	.	.	3
Heterocampa guttivitta (Wlk.)	Not	1	1	.	1	3
Glena cribrataria (Gn.)	Geo	.	2	.	.	2
Ennomos subsignaria (Hbn.)	Geo	.	2	.	.	2
Paonias myops (J.E. Smith)	Sph	1	.	.	1	2
Symmerista albifrons (J.E. Smith)	Not	.	2	.	.	2
Oligocentria semirufescens (Wlk.)	Not	.	.	1	1	2

SPECIES	Family	T90	C90	T91	C91	ABUND
Zanclognatha lituralis (Hbn.)	Noc	1	.	.	1	2
Nola triquetrana (Fitch)	Noc	.	2	.	.	2
Lithophane hemina Grt.	Noc	1	1	.	.	2
Lithophane unimoda (Lint.)	Noc	.	.	1	1	2
Orthosia rubescens (Wlk.)	Noc	.	2	.	.	2
Basilarchia archippus (Cram.)	Nym	.	.	.	1	1
Melanolophia signataria (Wlk.)	Geo	.	1	.	.	1
Lytrosis unitaria (H.-S.)	Geo	.	.	1	.	1
Pero honestaria (Wlk.)	Geo	.	.	1	.	1
Nacophora quernaria (J.E. Smith)	Geo	.	1	.	.	1
Eupithecia herefordaria C.&S.	Geo	1	.	.	.	1
Anisota virginiensis (Drury)	Sat	.	1	.	.	1
Symmerista leucitys Franc.	Not	.	.	.	1	1
Dasychira dorsipennata (B.&McD.)	Lym	.	.	.	1	1
Panopoda rufimargo (Hbn.)	Noc	.	.	1	.	1
Catocala ilia (Cram.)	Noc	1	.	.	.	1
Catocala amica (Hbn.)	Noc	1	.	.	.	1
Acronicta dactylina Grt.	Noc	.	1	.	.	1
Acronicta hasta Gn.	Noc	1	.	.	.	1
Acronicta impleta Wlk.	Noc	.	.	.	1	1
Eupsilia morrisoni (Grt.)	Noc	.	1	.	.	1
Copipanolis styracis (Gn.)	Noc	1	.	.	.	1
Orthosia alurina (Sm.)	Noc	.	1	.	.	1

†Lym = Lymantriidae, Noc = Noctuidae, Geo = Geometridae, Not = Notodontidae, Las = Lasiocampidae, Arc = Arctiidae, Sat = Saturniidae, Thy = Thyatiridae, Pap = Papilionidae, Sph = Sphingidae, Nym = Nymphalidae.

TABLE 5. Richness and abundance of non-target macrolepidopterous larval species under bands during pre-treatment 1990, post-treatment 1990 and 1991 at the treated and control sites at Coopers Rock State Forest, West Virginia. Numbers in parentheses indicate abundance of gypsy moth larvae.

	Treated		Control	
Period	Richness	Abundance	Richness	Abundance
Pre-1990	6	58 (95)	7	61 (237)
Post-1990	13	33 (378)	6	18 (1076)
1991	29	241 (355)	24	258 (4488)
Total	39	332 (828)	27	337 (5801)

TABLE 6. Macrolepidopterous larvae† under bands at Coopers Rock State Forest, West Virginia. Species are listed in decreasing order of total abundance for both treated (T) and control (C) blocks for 1990 and 1991.

SPECIES	Family	T90	C90	T91	C91	ABUND
Lymantria dispar (L.)	Lym	473	1313	355	4488	6629
Abagrotis alternata (Grt.)	Noc	43	52	56	53	204
Polia latex (Gn.)	Noc	.	.	108	94	202
Orthosia hibisci (Gn.)	Noc	12	7	5	8	32
Halysidota tessellaris (J.E. Smith)	Arc	.	.	12	18	30
Epiglaea decliva (Grt.)	Noc	9	1	9	10	29
Orgyia leucostigma (J.E. Smith)	Lym	.	.	1	22	23
Polia nimbosa (Gn.)	Noc	.	.	15	7	22
Dasychira basiflava (Pack.)	Lym	6	2	1	5	14
Malacosoma americanum (F.)	Las	3	7	.	.	10
Dasychira dorsipennata (B.&McD.)	Lym	3	4	1	1	9
Catocala ilia (Cram.)	Noc	2	1	4	1	8
Acronicta hasta Gn.	Noc	.	.	5	2	7
Malacosoma disstria Hbn.	Las	3	1	.	2	6
Dasychira obliquata (G.&R.)	Lym	.	.	2	4	6
Orthosia rubescens (Wlk.)	Noc	.	.	3	2	5
Hyphantria cunea (Drury)	Arc	.	.	1	3	4
Phlogophora periculosa Gn.	Noc	.	1	1	2	4
Lithophane hemina Grt.	Noc	.	.	3	1	4
Melanolophia canadaria (Gn.)	Geo	.	1	1	1	3
Zale minerea (Gn.)	Noc	.	.	2	1	3
Papilio glaucus L.	Pap	.	.	1	1	2
Phigalia titea (Cram.)	Geo	2	.	.	.	2
Campaea perlata (Gn.)	Geo	2	.	.	.	2
Catocala ultronia (Hbn.)	Noc	.	.	1	1	2
Alsophila pometaria (Harr.)	Geo	1	.	.	.	1
Itame pustularia (Gn.)	Geo	1	.	.	.	1
Hypagyrtis unipunctata (Haw.)	Geo	1	.	.	.	1
Erannis tiliaria (Harr.)	Geo	1	.	.	.	1
Lomographa glomeraria (Grt.)	Geo	1	.	.	.	1
Probole amicaria (H.-S.)	Geo	.	.	1	.	1
Lambdina pellucidaria (G.&R.)	Geo	1	.	.	.	1
Lambdina fervidaria (Hbn.)	Geo	.	.	1	.	1
Hydria prunivorata (Fgn.)	Geo	.	.	1	.	1
Paonias myops (J.E. Smith)	Sph	.	.	1	.	1
Nadata gibbosa (J.E. Smith)	Not	.	.	1	.	1
Lochmaeus manteo Doubleday	Not	.	1	.	.	1
Zale lunifera (Hbn.)	Noc	.	.	1	.	1
Parallelia bistriaris Hbn.	Noc	.	.	.	1	1
Catocala amica (Hbn.)	Noc	.	.	1	.	1

SPECIES	Family	T90	C90	T91	C91	ABUND
Acronicta ovata Grt.	Noc	.	.	1	.	1
Polia detracta (Wlk.)	Noc	.	1	.	.	1

†Lym = Lymantriidae, Noc = Noctuidae, Arc = Arctiidae, Las = Lasiocampidae, Geo = Geometridae, Pap = Papilionidae, Sph = Sphingidae, Not = Notodontidae.

TABLE 7. Richness and abundance of non-target macrolepidopterous larvae under bands of four tree species groups at combined sites for 1990 and 1991 combined. Numbers in parentheses indicate abundance of gypsy moth larvae.

Tree Species	Richness	Abundance
Black Birch	44	224 (1300)
Black Cherry	21	175 (1580)
Red Maple	13	96 (1214)
Mixed Oaks	8	174 (2535)
Total	41	669 (6629)